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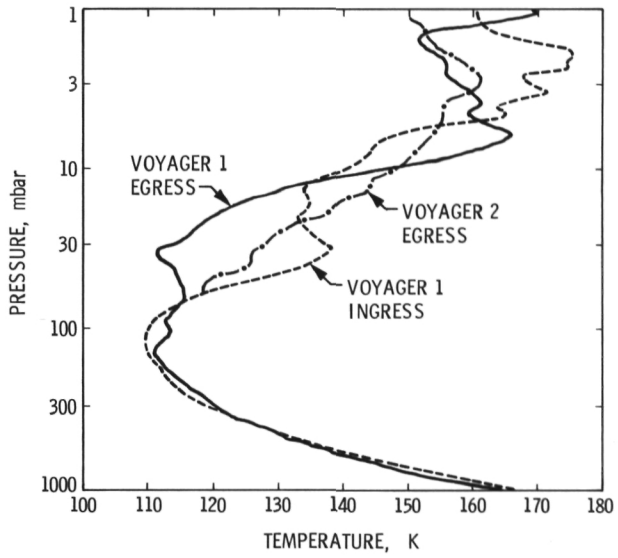
JUPITER'S ATMOSPHERE ANALYZED VIA VOYAGER RADIO OCCULTATION

Radio occultation measurements with Voyagers 1 and 2 have provided new information on the troposphere and stratosphere of Jupiter. Observations of spacecraft radio signals at 2.3 and 8.4 gigahertz have yielded profiles in height of the gas refractivity, molecular number density, pressure, temperature, and microwave absorption at latitudes ranging from 0 to about 70 degrees south. The data cover a pressure range from 1000 millibars to 1 millibar over a height interval of 160 kilometers.

At the 1000-mbar level, the temperature was 165 ± 7 kelvins; the main error source is the current uncertainty in the hydrogen-to-helium mixing ratio. The temperature lapse rate was equal to the adiabatic value of 2.1 K per kilometer, within the resolution of the measurements. The ammonia abundance in this region of the atmosphere was about 0.022 ± 0.008 percent -- in approximate agreement with the value derived from cosmic abundance considerations. The tropopause, which was detected near the 140-mbar level, had a temperature of 110 K.

Above the tropopause, the temperature increased with altitude, reaching 160 ± 20 K in the 10- to 1-mbar region of the stratosphere. Significant horizontal density variations were detected in the stratosphere. This may imply a non-uniform temperature and aerosol distribution across the Jovian disk, or high- and low-pressure regions due to local atmospheric dynamics. The gravity equipotential surface which best fits the 100-mbar isobaric surface has an equatorial radius of 71,541 ± 4 km and a polar radius of 66,896 ± 4 km.

This is the joint work of JPL, Stanford University's Center for Radar Astronomy, and SRI International's Radio Physics Laboratory.



Temperature profiles derived from doppler frequency perturbations observed on the S- and X-band tracking links during the occultations of the Voyager spacecraft by Jupiter. These profiles were computed for a gas mixture of 89 percent H_2 and 11 percent He.